REEDCOB - An eco-efficient building technology for monolithic walls based on earth and reeds

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New dwellings are needed all over the world. In developing countries new construction adopts modern materials such as fired bricks and cement concrete, consuming a large amount of energy for production of these building elements. Because of its apparent durability modern technology has been replacing ancient technology and causing a loss in vernacular knowledge still established in developing countries.

Trying to present alternatives to the previously mentioned status and also to define a technology that would give the possibility for unskilled craftsmanship to build easily and quickly, in a direct collaboration with FRADICAL company, it was decided to study an ecological and cost-controlled building technology for walls that can combine the use of materials that have been used in vernacular buildings all over the world, such as earth and air lime, with others also with low carbon footprint, as giant reeds in the form of cane and its fibres. Giant reed cane (Arundo Donax) is an invasive species in southern Europe which exists in excess in Portugal and in other countries. The aim is to develop a building technology capable of improving ancient vernacular knowledge but adapted to present time constraints and comfort needs.

A new technology for walls named “reedcob” was developed and has been characterized, namely by the building and monitoring of a prototype. The technology, based on cob walls, mainly consists on building monolithic walls but with successive layers of a mix based on earth and reed fibres, with low amounts of lime putty and pozzolan from ceramic waste, and layers of reeds.

The mix was optimised by using the following volumes: 1 of earth, 0.09 of lime putty, 0.06 of pozzolan and 1 of reed fibres. Therefore, the material of the walls is more than 50% from reed and the monolithic walls are lightweight compared to cob or rammed earth walls. Furthermore they do not need compaction as the previously mentioned techniques. Samples were produced and tested

mechanically and physically. The building technology itself was applied to build a prototype cabin 18 m^3. Five unskilled people - two architects and three civil engineering students – prepared the building materials, produced the mix and built the cabin walls in the Caparica Campus of NOVA University of Lisbon, 1 km from the Atlantic Ocean. A 40 cm thick wall foundation with stones and low cement-content concrete was built. Four wood pillars 7 cm x 7 cm section was previously inserted in the corners of the cabin walls foundation, at middle thickness, to increase bracing (Fig. 1). Supplementary low section wood pillars were placed in the lateral faces of the walls foundation to assure verticality during the building of the walls (fig. 1). Successive layers of the earth-reed fibres mix and layers of reeds (placed side by side) were applied to build the wall (fig.1). In the corners each layers of reeds were placed alternately in perpendicular directions, also to increase bracing. After four days, by the end July 2014, 2 m high walls were completed, and the lateral wood pillars were disassembled. The construction of the cabin has shown that the technology was easy and fast to use by unskilled craftsmanship. In September 2014 a thermal insulated roof and a door completed the cabin.

Figure 1: Reedcob cabin under construction showing: left - a reed layer, the bracing wood pillars in corner and the lateral pillars for verticality; right – a general view of the team

The cabin exterior surface has not been rendered (nor was the interior plastered), being exposed to weather conditions, namely rain and strong South wind (from the Atlantic). Only the South and West facades were lime washed. For the past 1.5 years the cabin has been monitored visually and continues to perform well; it has also been tested by non destructive techniques and exterior and interior temperature and relative humidity have been registered. Comparison to more common walls, based on earth as cob or rammed earth or concrete, has been made and results highlighted.

This new technology was developed to be used mainly in new construction in Europe, where giant reed is an invasive species, but it is foreseen that, in other Continents, the reed cane can be replaced by other types of reeds or bamboo.

References

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